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ABSTRACT

Young children and infants are especially vulnerable to serious injury in auto collisions because so few of them are protected by restraints or because legally required restraint devices are improperly used. Seat belt use laws tend to exclude children and child restraint legislation which exists includes gaps and shortcomings that limit its potential effectiveness. Recent empirical evidence from several countries indicates that infants and children can be protected by seat belts. Statistics from Australia indicate that fatalities were reduced among children who were covered by seatbelt laws, while fatalities among younger children excluded from the belt law remained about the same. Recent child restraint legislation in Australia and the U.S. has been associated with legally permitted but hazardous passenger behaviors such as avoiding the use of seat belts, placing children unrestrained in back seats and holding children on laps. It is urgent that all children be included in carefully formulated legislation requiring restraint use. However, improper use of restraint devices can reduce the effects of such legislation. It is likely that significant advances in the protection of children in cars will be achievable only through passive, automatic protective devices. (Author/RH)

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RESTRAINT USE LEGISLATION: ITS PROSPECTS FOR INCREASING THE PROTECTION OF CHILDREN IN CARS

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ABSTRACT

Very few children traveling in cars -- even fewer than adults -- are restrained, and effective ways need to be found to increase their crash protection. One potential mechanism for accomplishing this goal is through laws requiring restraint use. Unfortunately, seat belt use laws have tended to exempt children, and the increases in restraint use and decreases in occupant fatalities that have resulted from some of these laws have not been shared by children. Empirical evidence from several countries indicates that children can be protected by seat belts, and thus they should be included in belt use legislation. Several Australian states have now extended restraint use legislation to children less than eight years old, requiring them to use seat belts or child restraints. In the United States, Tennessee has a law in force requiring use of child restraints by children less than four years old. Present child restraint laws have major gaps and shortcomings that limit their potential effectiveness, and the data available at this writing indicate that the effects of the laws have, at best, been slight. It is likely that significant advances in protecting children in cars can be achieved only through implementation of measures that provide protection automatically to virtually all the people for whom they are available, whether children or adults.

RESTRAINT USE LEGISLATION: ITS PROSPECTS FOR INCREASING THE PROTECTION OF CHILDREN IN CARS

Allan F. Williams, Ph.D.

In the United States, where seat belt use is voluntary, few drivers -- only about 1 in 5 -- are restrained [Kirschner Associates, 1977]. Moreover, even fewer infants and children traveling in cars are restrained. In a 1974 survey involving cars leaving amusement areas and shopping centers in three states, 22% of the drivers of cars containing children less than ten years old were belted, whereas only 7% of the 8,893 children were protected from possible crash injuries by seat belts or child restraint systems [Williams, 1976].

Parents and others who transport children bear much of the responsibility for making sure that the children are restrained. Children, especially younger children and infants, cannot be expected to make and carry out informed decisions concerning restraint use, and parents are expected to provide for their children's protection, irrespective of their own use of restraints. Instead, it was found in the 1974 survey that when parents driving the cars were unrestrained, virtually all their children in the cars were unrestrained; and even when parents driving were themselves restrained, less than 25% of their children were restrained [Williams, 1976]. Similar findings have been reported concerning the lack of protection of children by both restrained and unrestrained drivers in crashes in North Carolina involving child occupants [Council, 1976].

Many parents and other adults unwittingly treat children in automobiles in ways that increase further the risk of crash injuries to those children,

while possibly decreasing their own risk. For instance, many infants and small children are held on laps during car travel, and in this position they not only cannot be restrained adequately, but are susceptible to being crushed in crashes by the persons holding them [Williams, 1978]. In one report on fatal crash injuries to children, it was noted that in several cases children on laps were killed, but the adults holding them sustained only minor injuries, probably because some of the crash energy was dissipated in crushing the children [Andersson and Jonasson, 1977].

It is clear that emphasis should be placed on ways to prevent crash injuries to children. Based on present knowledge, educating parents to protect their children in cars is not likely to further this goal. Educational programs for parents that have been competently evaluated have had little success in increasing proper use of restraints, or in decreasing the hazardous practice of holding infants on laps [Reisinger and Williams, 1978].

Belt Use Laws Exempt Children

One potential mechanism for increasing the protection of children in cars is through legislation requiring restraint use. In the 1970's, laws requiring seat belt use have been enacted in various countries other than the United States. Although not panaceas, many of these laws have resulted in moderate increases in belt use, and some are estimated to have reduced motor vehicle occupant deaths, generally by 10%-20% [Royal Australasian College of Surgeons, 1977].

Unfortunately, children of various ages and sizes were exempted from restraint use requirements in all legislation in force in the world through 1975. The ages and sizes of persons exempted from belt use vary considerably. For example, in Sweden persons less than 15 years old or 150 centimeters (59

inches) in height are exempted. In Ontario, Canada persons less than 5 years old or weighing less than 50 pounds (23 kilograms) are exempted.

In some European countries that require belt use in front seats, children are required to sit in back seats, where belts are usually not available. For example, Belgium exempts from its law persons less than 150 centimeters tall, and does not permit children less than 12 years old to occupy front seats if other seats are available. Switzerland prohibits children less than 12 years old from occupying front seats if other seats are available, and exempts persons of these ages from the front seat belt use requirement if they have to sit in front.

Effects of Belt Use Laws on Children

The question arises as to whether belt use laws that have increased belt use among adults have had any effect on the protection of children in cars. That is, when adults increase their use of belts because it is legally required, are they in turn more likely on a voluntary basis to see that children traveling with them are also restrained and thus less likely to be killed in cars? The limited evidence available suggests that they are not.

In fact, in the European countries that require belt use by front seat occupants, and require children up to ages 10-13 to sit in back seats the potential exists for a decrease in restraint use among children [Williams and Zador, 1977]. The laws in effect make it illegal for most children to be protected by belts, since automobiles in all European countries known to have passed such laws are not required to be equipped with seat belts in the back. Thus most children who have outgrown or do not have specially designed infant or child restraints are in effect required to be unrestrained, whereas before the laws went into force, they may have traveled in front seats and used seat

belts. Although back seat travel is preferable to front seat travel for unrestrained as well as restrained children, it has been found that restrained child passengers -- whether in front or back seats -- are less likely to be injured than unrestrained children even in back seats [Williams and Zador, 1977].

No studies are known in which the effects of the European laws on child seating locations and restraint use have been assessed.

Data obtained in Australia indicate that law-induced increases in belt use among adults have not been accompanied by increases in voluntary restraint of their children. Belt use rates on the order of 70%-80% have been observed in several Australian states after laws went into force [Robertson, 1978]. Boughton [1978] summarized five observational surveys conducted after Australian belt use laws went into force, indicating that only about one-third of children less than eight years old were restrained voluntarily, and concluded that although adults were experiencing the benefits of being restrained as a result of belt use legislation, children were being deprived of these benefits.

Thus children have not shared in the reductions in occupant fatalities reported to have resulted from belt use laws in Australia and some other countries. Data from Australia for the 1960-1974 period show clearly that while occupant deaths among the population covered by the law decreased significantly in the post-legislation period, deaths among children less than eight years old were "... consistent with what one would expect in the absence of legislation" [Johnston, 1977, p. 367]. For example, in Victoria, Australia, the belt use law went into force in late December, 1970. The statistics available from Victoria are categorized so that most children exempted from the law can be identified (those 0-6 years old rather than the

complete group 0-7 years old). The number of vehicle occupant deaths among those aged seven or more was 718 in 1970, compared to an annual average of 570 in 1971-1974, a 21% decrease. Among children less than seven years old, there were 27 deaths in 1970, compared to an annual average of 25 in 1971-1974, a 7% decrease [Australian Bureau of Statistics, 1975].

In New South Wales, Australia, the death rate for children not covered by the belt use law increased after the law went into force, whereas the death rate for adults decreased [Herbert, 1977].

It is clear that because of the very low use of restraints by children in cars, and the failure of parents and other adults to insure voluntarily that children are protected from possible crash injuries, children should be included in legislation requiring restraint use. In the remainder of this paper, recent developments concerning restraint use legislation for children are discussed.

Seat Belts Provide Crash Protection to Children

A major reason for exempting children from belt use legislation is the belief, scientifically unfounded, that because of various structural and biological differences between children and adults, seat belt systems designed and tested for adult use are not capable of providing children with crash protection, and may, in fact, do more harm than good.

The empirical evidence now available from several countries indicates that infants and children can be protected by seat belts. There is increasing recognition that this is so, and that infants and children should not be exempted from belt use requirements on this basis.

It has been argued by some that belts are inappropriate for children even up to age 15. For example, in a recent report it was stated that children of

ages 4 to 7 until 12 to 15 comprise a group "... for which no particular protective device -- such as a child seat or a seat belt -- is available" [Nordic Road Safety Council, 1975, p. 81].

However, research in Sweden, based on 683 crashes involving at least one child less than age 15, has indicated the appropriateness of seat belts for this age group. It was found in this study that belted children were less likely than unbelted children to be injured, that children were protected by seat belts to the same degree as adults, and that neck injuries resulting from shoulder straps passing close to the necks of child occupants were not a problem [Norin and Andersson, 1977]. In the United States, data on 26,971 passengers less than 15 years old in crashes in North Carolina indicated that use of restraints (in almost all cases, seat belts, rather than child restraints) reduced the injury rate by 39% in front seats and 31% in back seats [Williams and Zador, 19[illegible]. In another study in which six children, ranging in ages from 3-9, were using lap belts when crashes occurred, it was concluded that the belts provided effective protection in each case [Melvin, Stalnaker, and Mohan, 1978].

Actually, much of the debate concerning the appropriateness of seat belts for children has centered on whether very young children and infants can be protected by belts. Snyder and O'Neill [1975] reviewed crash data then available in the United States on children aged five or less and concluded that in the absence of specially designed child and infant restraint systems, younger children (and infants) should use lap belts and even three-point belt systems designed for adults. Henderson, Herbert, Vazey, et al. [1976] studied crash data in Australia and concluded that "... children appear to be afforded good protection by the lap/sash adult belt system, even down to two years of age, as long as the restraint is properly adjusted" [p. 35]. They also

concluded that the use of an adult seat belt by "children of any age" is preferable to the use of no restraint [p. 38]. In subsequent research by Vazey [1977] these conclusions were reaffirmed, but it was emphasized that the seat belt must be "pulled tight" around the child [p. 25]. In most cases of belt use by children that were studied, the belts were adjusted very loosely and did not provide adequate restraint.

Taking the existing empirical evidence into account, the Child Restraint Discussion Group of the Sixth International Conference of the International Association for Accident and Traffic Medicine recommended that "... in the absence of a child restraint, a child, however young, should be restrained by an adult belt where available," [Royal Australasian College of Surgeons, 1977, p. 251] and noted that "Concern about a small child suffering neck injuries or submarining appear to be generally unfounded" [p. 251]. These recommendations were incorporated in the resolutions of the conference, which stated "that children able to sit up unsupported may safely use and should be required to use adult seat belts if no more suitable devices are available" [p. 2]. It was also recommended that mandatory seat belt use laws should cover all occupants of passenger cars irrespective of seating position and age.

Child Restraint Legislation

Australia

Several Australian states have recently extended restraint use legislation to younger children and infants, and in most cases have required proper use of child restraints, or use of seat belts alone. Belt use laws enacted by Australian states in the early 1970's exempted children, usually those less than eight years old, but in 1976 and 1977, legislation requiring

children of these ages to be restrained went into force in several states. In Victoria, a law went into force in January, 1976, requiring persons less than eight years in front seats to be properly restrained in child restraints approved by the Victorian Police Commissioner or the Standards Association of Australia (SAA), or by seat belts [Motor Car (Child Seat Restraints) Act 1975]. In Tasmania, since November 1977, children less than eight years old in front seats must be properly restrained by a SAA-approved child restraint [Traffic (general and local) Amendment Regulations, 1977]. In Western Australia, since March, 1977, persons 5-7 years of age must use available seat belts unless using a child restraint approved by the SAA [Traffic Regulation 1621, 1977]. In New South Wales, since March, 1977, persons less than eight years old must wear suitable restraints, if available in any seating compartment in the car. Suitable restraints are defined as SAA-approved child restraints or, if the child is at least one year old, seat belts. There is the further provision that children may not sit in front seats, when there is an unoccupied back seat position, unless they are restrained. However, drivers are not bound by these regulations if contravening them "... is necessary for the safety or well-being of the child or any other occupant of the motor car." [Motor Traffic Act, 1977].

Preliminary results are available on effects of the legislation in Victoria and New South Wales. In Victoria, the legislation exempts children from restraint requirements if they sit in back seats. Surveys conducted in Melbourne, Victoria, before and after the law was in force indicate that back seat travel increased somewhat, from 79% to 85% in one survey [Vulcan, 1977] and from 80% to 86% in another [Boughton, Lancashire, and Johnston, 1977]. The two surveys disagree, however, on the effects of the law's provision that children in front seats use restraints. The disparity is likely due to

differences between the two studies in the types of observation sites chosen, and in times of the day and days of the week when observations were made. That is, the Vulcan [1977] survey was conducted at six shopping centers and at three intersections of arterial roads from 9 a.m. to 4 p.m. on week days. The Boughton et al. [1977] survey was done at arterial road intersections between 6 a.m. and 12 midnight and included weekend days. In the Vulcan [1977] survey, front seat use rates increased from 29% to 60%. In the Boughton et al. [1977] survey, which probably provides a better representation of children's car trips, 27% of those in front seats were using seat belts or child restraints prior to the law, compared to 26% when the law was in force. Taking into account children in both front and back seats, in the Vulcan [1977] survey restraint use increased from 34% to 41%, compared to a 38% to 32% decrease in the Boughton et al. [1977] survey.

In Sydney, New South Wales -- as in Victoria -- two surveys have been undertaken which agree that there has been a significant relocation of children from front to back seats subsequent to the law, but disagree somewhat as to the effect of the law on restraint use. In one study [Fleming, 1977] observations were made at shopping centers during school hours and included mainly children less than four or five years of age. In this study, 24% of children in front seats were using restraints prior to the law, compared to 26% when the law was in force. When all seating locations were considered, rates of children judged to be adequately restrained by seat belts or SAA-approved child restraints increased from 33% to 44%. In a more representative survey in which observations were made at shopping centers during and after school hours and on Saturday mornings, as well as at other locations, use rates for all children irrespective of seating location decreased from 37% to 35% subsequent to the law, although front seat use rates increased from 27% to 36% [Boughton, 1978a].

Tennessee

No state in the United States has passed a law requiring seat belt use by adults. However, Tennessee passed a restraint use law effective January 1, 1978, exclusively for children. The law requires parents of children less than four years old to use child restraint systems when transporting their children in cars, and to insure that the restraints are used properly. As an alternative to such travel, children are permitted to be held in the arms of older passengers [Tennessee Code Annotated, 1977].

A study of the early effects of the law was made in its fourth month [Williams, in press]. Visual observations of children in cars were made before and after the law was in force in Knoxville and Nashville in Tennessee, and in Lexington and Louisville in Kentucky, an adjacent state not having a child restraint law and thus providing an indication of trends in restraint use unrelated to the law.

It was found in this survey that rates of using child restraints anchored by seat belts increased in Tennessee (8% to 16%) to a somewhat greater extent than in Kentucky (11% to 15%). However, these results also indicate that more than 80% of Tennessee children were unrestrained in the fourth month the law was in force. Moreover, the potential of the law for harm because on-lap travel is explicitly permitted cannot be discounted, as there was a net increase in such travel in the two Tennessee cities studied, relative to a decrease in the two Kentucky cities.

Other states in the U.S. are now reported to be considering restraint use legislation for children. As Waller, Li, Campbell, et al. [1977] have noted, promotion of restraint use legislation for children is in keeping with society's "... responsibility for those citizens who, by reason of age, infirmity, or financial condition, are not able to provide for their own

welfare (ch. 7, p. 6)," and is in line with laws to protect the health and well being of children until they reach the age of legal maturity, e.g., laws prohibiting child labor, and laws that provide for inoculations.

Potential Effectiveness of Child Restraint Legislation

The recent extension of restraint legislation to children is an important development. However, the laws passed thus far, which vary greatly in terms of restraint requirements, contain a number of gaps and shortcomings that limit their potential effectiveness. For example, in Tennessee the hazardous practice of on-lap travel is permitted as a legal alternative to use of restraints. Moreover, the Tennessee law covers only those persons three years of age or younger; older children are not required to be restrained. In Victoria, children are exempted from restraint requirements if they sit in back seats, whereas adults are not. In New South Wales, restraints need not be used unless available, and thus when no belts are available, use requirements can be avoided by not placing child restraints in the car. The New South Wales legislation also has a loophole in that restraint requirements are waived if necessary for the "well being" of the child or other occupants.

It should be kept in mind that enactment of child restraint legislation --even if not containing the gaps and shortcomings of present laws -- does not guarantee reductions in deaths and injuries of child car occupants. The 10% to 20% reductions in occupant fatalities estimated to result from some of the belt use laws for adults is probably the maximum effect achievable. At the worst, child restraint laws may have no positive effects on fatalities, and possibly even negative effects, e.g., in cases such as Tennessee where the law may promote harmful practices.

Early results on laws presently in force suggest that their effects, at best, will be modest. For example, the Australian child restraint legislation has been much less effective in increasing child use rates than Australian belt use laws for adults, whichever of the existing survey results are considered. Moreover, it is known that children often travel in restraints that are used improperly, in ways that degrade crash protection (e.g., the vehicle lap belt is not used to anchor the device; the harness system on the device is not used to secure the child in it). This problem may become more acute when restraints are worn to comply with laws [Freedman and Lukin, 1977]. At this writing, the data available on child occupant fatalities in Australian states with child restraint laws indicate little change that can be attributed to the laws [Boughton and Milne, 1978].

Conclusions

It is likely that significant advances in the protection of children in cars, as well as other vehicle occupants, are achievable only through providing "passive" (automatic) protection [Haddon, 1961, 1962, 1974; Haddon and Baker, 1978; Kelley, 1975], rather than relying only on strategies that always require a special action by or for each individual, e.g., placing children in appropriate restraints on each and every motor vehicle trip and making sure that the restraints are properly adjusted and anchored so that they provide appropriate crash protection. Passive countermeasures include non-lacerating windshields and door glazing, crash-padding, doors that always stay shut in crashes, restraints such as air bags: in brief, vehicle designs -- technologically feasible for many years -- that better handle crash forces both internal and external to their passenger compartments [Miller and Green, 1977; DiNapoli, Fitzpatrick, Strother, et al. 1977]. The great

advantage of passive countermeasures is that they provide protection to virtually all the people for whom they are available, compared, for example, to the much lower percentages of people -- often excluding those most likely to be in crashes -- who use restraint systems that require individual action, whether or not such use is required by law.

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